Central Precocious Puberty

Subjects: Genetics & Heredity
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Central precocious puberty is a condition that causes early sexual development in girls and boys.

Keywords: genetic conditions ; puberty ; precocious puberty

1. Introduction

While puberty normally starts between ages 8 and 13 in girls and between ages 9 and 14 in boys, girls with central precocious puberty begin exhibiting signs before age 8, and boys with this disorder begin before age 9. Signs of puberty include development of pubic and underarm hair, a rapid increase in height (commonly referred to as a "growth spurt"), acne, and underarm odor. Girls also develop breasts and begin their menstrual periods. Boys have growth of the penis and testes and deepening of the voice. Because of the early growth spurt, children with central precocious puberty may be taller than their peers; however, they may stop growing abnormally early. Without proper treatment, some affected individuals are shorter in adulthood compared with other members of their family. Developing ahead of their peers can be emotionally difficult for affected individuals and may lead to psychological and behavioral problems.

2. Frequency

Central precocious puberty is estimated to affect 1 in 5,000 to 10,000 girls. The condition is less common in boys, although the prevalence is unknown.

3. Causes

The cause of central precocious puberty is often unknown. The most common known genetic cause of central precocious puberty is mutations in the *MKRN3* gene. Changes in other genes are rare causes of the condition, and researchers suspect that changes in genes that have not yet been identified may also be involved in central precocious puberty. The timing of puberty is influenced by several factors in addition to genetics, including nutrition, socioeconomic status, and exposure to certain chemicals in the environment.

The protein produced from the *MKRN3* gene plays a role in directing the onset of puberty. Puberty begins when a gland in the brain called the hypothalamus is stimulated to release bursts of a hormone called gonadotropin releasing hormone (GnRH). This hormone triggers the release of other hormones that direct sexual development. Research suggests that the MKRN3 protein blocks (inhibits) the release of GnRH from the hypothalamus, thus holding off the onset of puberty.

The *MKRN3* gene mutations involved in central precocious puberty are thought to lead to production of a nonfunctional MKRN3 protein. Although the mechanism is unclear, researchers speculate that without the MKRN3 protein to inhibit GnRH release, the hypothalamus releases bursts of the hormone, which stimulates the onset of puberty earlier than normal.

For most genes, both copies of the gene (one copy inherited from each parent) are active in all cells. However, the activity of the *MKRN3* gene depends on which parent it was inherited from. Only the copy inherited from a person's father is active; the copy inherited from the mother is not active. This sort of parent-specific difference in gene activation is caused by a phenomenon called genomic imprinting. Because only the copy of the *MKRN3* gene from the father is active, when associated with this gene, the condition can only be inherited from a person's father. Either sons or daughters can have central precocious puberty, although researchers suspect that girls are more severely affected than boys, because the onset of puberty is even earlier than normal in girls than in boys. Boys with an *MKRN3* gene mutation inherited from their father may go through puberty at the lower limit of the normal age range, so the condition is not diagnosed.

3.1. The Gene Associated with Central Precocious Puberty

- MKRN3

4. Inheritance

Central precocious puberty follows an autosomal dominant pattern, which means one copy of the altered gene in each cell is sufficient to cause the disorder. When passed from parent to child, the condition is known as familial central precocious puberty. In familial cases associated with the *MKRN3* gene, the mutation is inherited from the father. In many cases, the father is affected; however, he may be unaffected if he inherited the altered gene from his mother. A father may also be unaffected because some males with a mutation do not show signs of the condition. A father can pass the condition to his sons and daughters.

The condition can also occur in people with no family history of the disorder. These cases are called sporadic central precocious puberty. Some apparently sporadic cases are caused by *MKRN3* gene mutations inherited from an unaffected father.

5. Other Names for This Condition

- CPP
- gonadotropin-dependent precocious puberty

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